Claims:

1. A method of coating a liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the liquid onto the substrate comprising:

providing an agent-containing coating liquid;

conveying the coating liquid onto a liquid-holding surface having a coating transfer region;

controlling the depth of the coating liquid at the coating transfer region to a predetermined depth; and

immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region.

2. A method of coating a liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the liquid onto the substrate comprising:

providing an agent-containing coating liquid;

conveying the coating liquid onto a liquid-holding surface having a coating transfer region;

controlling the depth of the coating liquid at the coating transfer region to a predetermined depth; and

immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region, wherein the microprojections have a length, as measured from a surface or edge of the substrate, which is greater than said predetermined depth.

3. A method of coating a liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the liquid onto the substrate comprising:

providing an agent-containing coating liquid;

conveying the coating liquid onto a liquid-holding surface having a coating transfer region;

controlling the depth of the coating liquid at the coating transfer region to

a predetermined depth; and

immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region, wherein the microprojections have a length, as measured from a surface or edge of the substrate, which is greater than said predetermined depth, and wherein the depth of the coating liquid at the coating transfer region is greater than said microprojection immersion.

4. A method of coating a liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the liquid onto the substrate comprising:

providing an agent-containing coating liquid;

conveying the coating liquid onto a liquid-holding surface having a coating transfer region, the liquid-holding surface being a surface of a roller;

controlling the depth of the coating liquid at the coating transfer region to a predetermined depth; and

immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region.

5. A method of coating a liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the liquid onto the substrate comprising:

providing an agent-containing coating liquid;

conveying the coating liquid onto a liquid-holding surface having a coating transfer region;

controlling the depth of the coating liquid at the coating transfer region to a predetermined depth; and

immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region, wherein the liquid-holding surface is a surface of a roller, and wherein the conveying of the coating liquid is achieved by rotating a portion of the roller through a bath of the coating liquid.

6. A method of coating a liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the liquid onto the substrate comprising:

providing an agent-containing coating liquid;

conveying the coating liquid onto a liquid-holding surface having a coating transfer region;

controlling the depth of the coating liquid at the coating transfer region to a predetermined depth; and

immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region, wherein the liquid-holding surface is a surface of a roller, wherein the conveying of the coating liquid is achieved by rotating a portion of the roller through a bath of the coating liquid, and wherein the depth of the coating liquid is controlled by controlling the rotational speed of the roller.

7. A method of coating a liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the liquid onto the substrate comprising:

providing an agent-containing coating liquid;

conveying the coating liquid onto a liquid-holding surface having a coating transfer region;

controlling the depth of the coating liquid at the coating transfer region to a predetermined depth; and

immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region, wherein the immersing of the microprojections is accomplished by conveying the substrate along a predetermined pathway adjacent the coating transfer region.

8. A method of coating a liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the liquid onto the substrate comprising:

providing an agent-containing coating liquid;
conveying the coating liquid onto a liquid-holding surface having a coating transfer region;
controlling the depth of the coating liquid at the coating transfer region to a predetermined depth; and
immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region, wherein the immersing of the microprojections is accomplished by continuously conveying a web comprised of a plurality of said substrates along a predetermined pathway adjacent the coating transfer region.

9. A method of forming a solid coating on a plurality of microprojections extending from a surface or edge of a substrate without forming a coating on the substrate, comprising;
providing an agent-containing coating liquid;
conveying the coating liquid onto a liquid-holding surface having a coating transfer region;
controlling the depth of the coating liquid at the coating transfer region to a predetermined depth;
immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region;
removing the microprojections from the coating liquid; and
drying the coating liquid coating the microprojections thereby forming a solid agent-containing coating on the microprojections.

10. A method of forming a solid coating on a plurality of microprojections extending from a surface or edge of a substrate without forming a coating on the substrate, comprising:
providing an agent-containing coating liquid;
conveying the coating liquid onto a liquid-holding surface having a coating transfer region;
controlling the depth of the coating liquid at the coating transfer region to

a predetermined depth;
immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region;
removing the microprojections from the coating liquid;
drying the coating liquid coating the microprojections thereby forming a solid agent-containing coating on the microprojections; and
repeating said coating, removing and drying to provide multiple coatings on said microprojections.

11. A method of forming a solid coating on a plurality of microprojections extending from a surface or edge of a substrate without forming a coating on the substrate, comprising:
providing an agent-containing coating liquid;
conveying the coating liquid onto a liquid-holding surface having a coating transfer region;
controlling the depth of the coating liquid at the coating transfer region to a predetermined depth;
immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region;
removing the microprojections from the coating liquid; and
drying the coating liquid coating the microprojections thereby forming a solid agent-containing coating on the microprojections, wherein the agent is a drug or a vaccine and the liquid comprises water.

12. A method of forming a solid coating on a plurality of microprojections extending from a surface or edge of a substrate without forming a coating on the substrate, comprising:
providing an agent-containing coating liquid;
conveying the coating liquid onto a liquid-holding surface having a coating transfer region;
controlling the depth of the coating liquid at the coating transfer region to a predetermined depth;

immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region;

removing the microprojections from the coating liquid; and
drying the coating liquid coating the microprojections thereby forming a solid agent-containing coating on the microprojections, wherein the coating liquid is comprised of a liquid solvent and the agent, the coating liquid having an agent concentration, and said agent concentration is controlled by a method selected from the group consisting of:

conducting said coating at an atmospheric temperature, or at a coating liquid temperature, which reduces evaporative loss of said liquid solvent;

conducting said coating in an atmosphere containing sufficiently high amounts of gaseous solvent to reduce evaporative loss of said liquid solvent;

Infusing liquid solvent into said coating liquid at a rate which compensates for evaporative loss of said liquid solvent; and

combinations thereof.

13. A method of forming a solid coating on a plurality of microprojections extending from a surface or edge of a substrate without forming a coating on the substrate, comprising:

providing an agent-containing coating liquid;
conveying the coating liquid onto a liquid-holding surface having a coating transfer region;
controlling the depth of the coating liquid at the coating transfer region to a predetermined depth;
immersing the microprojections to a predetermined level in the coating liquid at the coating transfer region;
removing the microprojections from the coating liquid; and
drying the coating liquid coating the microprojections thereby forming a solid agent-containing coating on the microprojections, wherein the

coating liquid is comprised of a liquid solvent and the agent, the coating liquid having an agent concentration, and said agent concentration is controlled by a method selected from the group consisting of:

i) conducting said coating at a temperature which reduces evaporative loss of said liquid solvent;

ii) conducting said coating in an atmosphere containing sufficiently high amounts of gaseous solvent to reduce evaporative loss of said liquid solvent;

iii) Infusing liquid solvent into said coating liquid at a rate which compensates for evaporative loss of said liquid solvent; and

iv) combinations thereof.

wherein the liquid solvent comprises water, the temperature is less than about 10°C, and the atmosphere has a relative humidity greater than about 60%.

14. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating liquid at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region.

15. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a curved liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;
a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and
a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region.

16. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:
a liquid holding surface having a coating transfer region, the liquid holding surface being an outer surface of a rotatable cylindrically-shaped roller;
a coating liquid conveyor for providing the coating liquid at the coating transfer region;
a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and
a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region.

17. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:
a liquid holding surface having a coating transfer region, the liquid holding surface being an outer surface of a rotatable cylindrically-shaped roller;
a coating liquid conveyor for providing the coating liquid at the coating transfer region;
a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and
a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating

transfer region, wherein the coating liquid conveyor comprises rotating the roller through a bath of said coating liquid.

18. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region, the liquid holding surface being an outer surface of a rotatable cylindrically-shaped roller;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller comprising a doctor blade for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the coating liquid conveyor comprises rotating the roller through a bath of said coating liquid.

19. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the liquid holding surface is an outer surface of a rotatable cylindrically-shaped roller, wherein the coating liquid conveyor comprises rotating the roller through a bath of said coating liquid, wherein the coating liquid depth controller comprises a second roller, substantially

parallel with the liquid holding surface roller and spaced a predetermined distance therefrom and forming a nip therebetween.

20. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region, the liquid holding surface being an outer surface of a rotatable cylindrically-shaped roller;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the coating liquid conveyor comprises rotating the roller through a bath of said coating liquid, wherein the coating liquid depth controller comprises a second roller, substantially parallel with the liquid holding surface roller and spaced a predetermined distance therefrom and forming a nip therebetween, and wherein the two rollers rotate in the same rotational direction.

21. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth;

and a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating

transfer region, wherein the liquid holding surface is an outer surface of a rotatable cylindrically-shaped roller, wherein the coating liquid conveyor comprises rotating the roller through a bath of said coating liquid, wherein the coating liquid depth controller comprises a second roller, substantially parallel with the liquid holding surface roller and spaced a predetermined distance therefrom and forming a nip therebetween, including a doctor blade wiping the surface of the second roller upstream of the nip.

22. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

an immobile liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region.

23. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

an immobile liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the coating liquid conveyor causes the coating liquid to flow, by force of gravity, over the immobile liquid holding surface.

24. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

an immobile liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the coating liquid conveyor causes the coating liquid to flow, by force of gravity, over the immobile coating surface, and the immobile liquid holding surface, in the coating transfer region, is substantially planar.

25. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

an immobile liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the coating liquid conveyor causes the coating liquid to flow, by force of gravity, over the immobile coating surface, and the immobile liquid holding surface, in the coating transfer region, is curved.

26. An apparatus for coating an agent-containing liquid onto a plurality of

microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

an immobile cylindrically-shaped liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the coating liquid conveyor causes the coating liquid to flow, by force of gravity, over the immobile liquid holding surface.

27. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the substrate conveyor comprises a track which is adjustably positionable to a predetermined distance from the coating transfer region and a substrate holding sled which runs along the track.

28. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating

transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, including a continuous substrate conveyor for continuously conveying a series of said substrates and microprojections through the coating liquid.

29. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, including a continuous substrate conveyor for continuously conveying a series of said substrates and microprojections through the coating liquid, wherein the continuous substrate conveyor comprises a substrate supply roll and a substrate take-up roll.

30. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at further the coating transfer region to a predetermined depth; and

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, including a continuous substrate conveyor for continuously conveying a series of said substrates and microprojections through the coating liquid, wherein the continuous substrate conveyor comprises a substrate supply roll and a substrate take-up roll, further including a substrate guide for positioning the continuous substrate relative to the coating transfer region.

31. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at further the coating transfer region to a predetermined depth;

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the coating liquid is comprised of a liquid solvent and the agent, the coating liquid having an agent concentration; and

means for controlling said agent concentration selected from the group consisting of;

a temperature controller for controlling the temperature of said coating to a level which reduces evaporative loss of said liquid solvent;

a coating atmosphere controller for controlling levels of gaseous solvent in an atmosphere surrounding said coating which reduces evaporative loss of said liquid solvent;

a liquid solvent infusor for infusing liquid solvent into said coating liquid at a rate which compensates for evaporative loss of said liquid solvent; and

combinations thereof.

32. An apparatus for coating an agent-containing liquid onto a plurality of microprojections extending from a surface or edge of a substrate substantially without coating the substrate, comprising:

a liquid holding surface having a coating transfer region;

a coating liquid conveyor for providing the coating liquid at the coating transfer region;

a coating liquid depth controller for controlling the depth of the coating at further the coating transfer region to a predetermined depth;

a substrate conveyor for conveying the microprojections at a predetermined level of immersion through the coating liquid at the coating transfer region, wherein the coating liquid is comprised of a liquid solvent and the agent, the coating liquid having an agent concentration; and

means for controlling said agent concentration selected from the group consisting of;

a temperature controller for controlling the temperature of said coating to a level which reduces evaporative loss of said liquid solvent;

a coating atmosphere controller for controlling levels of gaseous solvent in an atmosphere surrounding said coating which reduces evaporative loss of said liquid solvent;

a liquid solvent infusor for infusing liquid solvent into said coating liquid at a rate which compensates for evaporative loss of said liquid solvent; and

combinations thereof.

wherein the liquid solvent comprises water, the temperature is less than about 10°C, and the atmosphere has a relative humidity greater than about 60%.